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This carefully controlled "near miss" explosion helped the Navy to validate the battle-worthiness of its newest frigate, the USS OLIVER HAZARD PERRY (FFG 7) - and Tracor Marine was there to help do the job right. The navy asked us to fabricate the suspension pontoon for the 10 000 lbs. of HBX, provide the riggers and boathandlers, and otherwise assist in this test operation.

AND THAT'S NOT ALL WE'VE DONE LATELY . . .

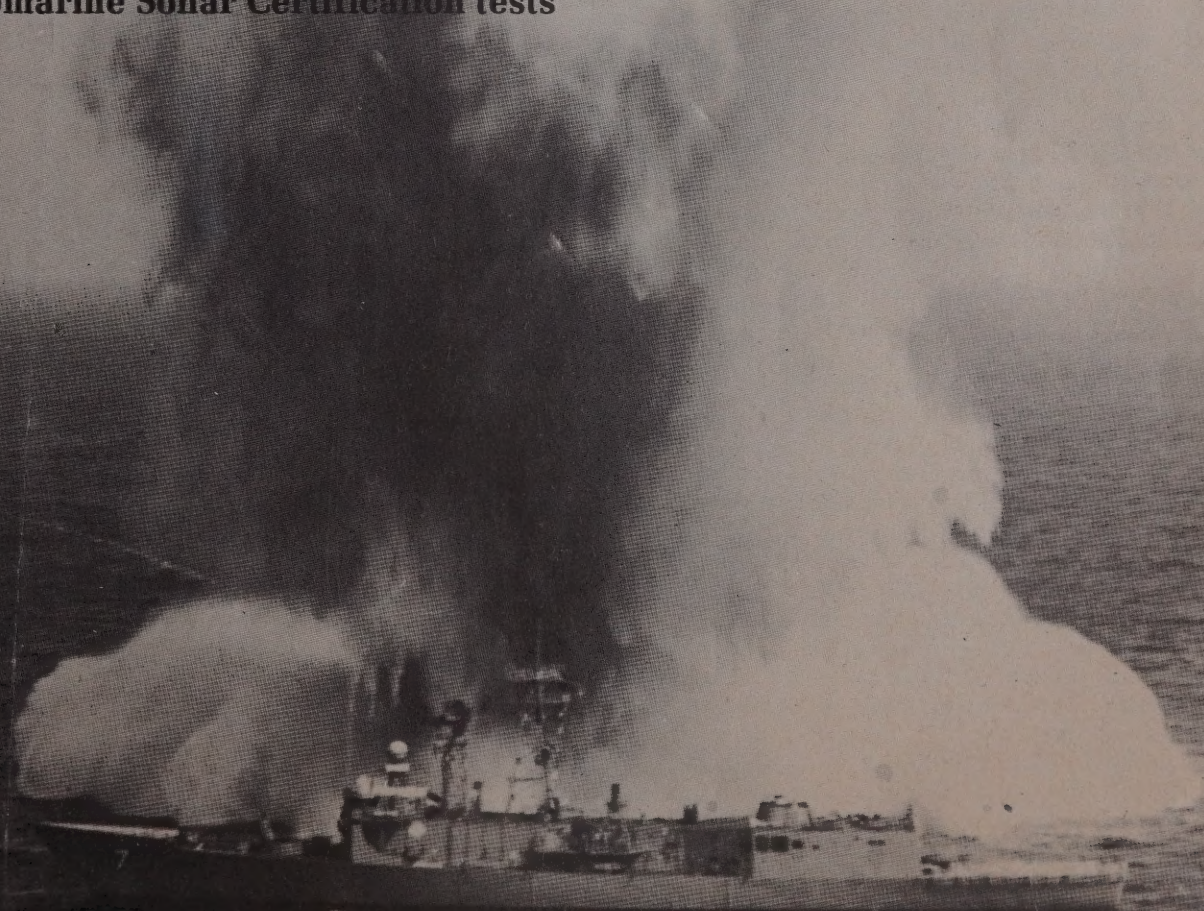
We completed the first million air miles of safe operation of our two bailed Navy P-3 aircraft, flown in support of the Sonobuoy Qualification Assurance Program.

We designed, fabricated, tested, and delivered two oceanographic/towing winches, one to the Navy and the other Western Electric.

We continued our support of the Navy's FBM submarine Sonar Certification tests

with our R/V H.J.W. FAY, deployed to the Eastern Atlantic.

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CIRCLE NO. 5 ON INQUIRY CARD

Bell Systems ASW Work In World War II

It was in 1940 that Bell Laboratories undertook to investigate underwater acoustics exploratory research to try to put into numbers what previously had been subjective analysis in the detection of submarines.

The Bell System had become involved in defense applications of electroacoustics many years before. In trying to turn this knowledge from air and land applications to the undersea world experiments were conducted in Crystal Lake in Mountain Lakes, N.J. It was a body of water that had a soft, low-reflectivity bottom. At that time there were no underwater transducer standards for which the electrical-to-acoustical conversion characteristics could be determined by computation or simple air calibration characteristics.

Thus the Bell System was launched into becoming a major anti-submarine warfare (ASW) contractor, a role that continues to this day through Bell Laboratories and Western Electric Company.

Here is a brief account of Bell's World War II journey into this field, the information adapted from Chapter Four of "Engineering and Science in The Bell System."

In 1941 Division 6 of the National Defense Research Committee (NSRDC), whose main responsibility was ASW, became interested in the work of Bell at the lake. It contracted with Western Electric to develop standard hydrophones, sound sources and calibrating procedures. The work at Crystal Lake was expanded and another test site established at Lake Gem Mary in Orlando, Fla.

When the U.S. entered World War II Western Electric became an equipment sponsor. To avoid conflict of interest possibilities, it asked that the test facilities be transferred to others. They were shifted to Columbia University. They became the Underwater Sound Reference Laboratories. They were transferred back after the war.

A number of Bell System people, including F.B. Jewett and O.E. Buckley had worked on submarine detection in World War I. They

recognized the submarine as a major threat to the allies.

Echo ranging had been known since the first World War. It depends on creating a sound pulse, having it reflected from a body, the return sound received and measuring the time difference to determine distance. Sound in water travels between 1,432.5 meters a second to 1,524 meters a second, depending on water temperature, salinity and pressure (depth). The average figure is 1,462 meters a second.

The Navy had a supply source for some sonars, but wanted another. Bell was chosen to develop sonar for ASW, patrol ships only, but it proved so successful that it was chosen for destroyers as well. The first sonar, the QBF, went into production in 1943, with the QJA following in 1944. With this equipment sonar noises could be shifted down to an audible range so that a trained operator could determine whether the object was a submarine, surface ship or marine life.

Active (pinging) sonar was an excellent piece of equipment for that period for German submarine crews wore rubber soled shoes and worked with rubber hammers while the electric motors turned the propellers so slowly they were silent.

Another early development concerned the crystals used in transducers and hydrophones. At first Rochelle salts were used but they had limited temperature range and power handling capacity. The next step was ammonium dihydrogen phosphate (ADP), which, when gold plated, were much superior.

Paralleling the acoustic work was that of magnetic detection. Bell development of magnetic anomaly detection (MAD) was carried out at the request of the Naval Ordnance Laboratory. This work resulted in the development of the AN/ASQ-3 and 3A MAD airborne detectors, whose descendants are in use today for final localization of submarines after initial detection and tracking. Bell was also involved in the development of acoustic mines and torpedos. □



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Pierre G. Dallemagne

Pierre G. Dallemagne Ph.D.
Chief Oceanographer

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CIRCLE NO.27 ON INQUIRY CARD

Contracts & Orders

RCA Astro-Electronics, Princeton, N.J., \$18.7 million contract for NOVA navigation satellite, advanced version of USN Transit satellite. (Navy Strategic Systems Project Office)

Land and Marine Engineering, Merseyside, U.K., \$12 million contract to lay a 9-mile pipeline across Bombay Harbor offshore India. The line will form the central section of the supply line that will bring India's oil onshore. (Oil & Natural Gas Commission, Bombay, India)

Simplex Wire and Cable Co., Portsmouth, N.H., \$16.7 million contract plus \$12 million options for continuing oceanographic research. (Naval Electronic Systems Command)

United Towing Ltd., Hull, U.K., contract (terms not announced) to tow a damaged 330,000-ton supertanker from South Africa to Japan's Mitsubishi yard in Nagasaki. (Bethlehem Steel, Beaumont, Tex.)

Sanders Associates, Inc., Nashua, N.H., \$10.5 million contract for provision and installation of electronic warfare training equipment in HS-748 aircraft operated by the Royal Australian Navy. (Ministry of Defense, Commonwealth of Australia)

Marathon LeTourneau, Vicksburg, Miss., \$17 million contract to construct a 150-ft. cantilevered jackup. Delivery is planned for July 1979. (Keyes Offshore, Houston, Tex.)

Honeywell, Inc., Marine Systems Division, West Covina, Cal., \$4,322,000 contract to provide AN/BQR-21 sonar system program management and support. (Naval Sea Systems Command)

Geosource, Houston, Tex., \$7 million contract to supply valves, meters and metering equipment for the planned deepwater terminal offshore Louisiana. (Louisiana Offshore Oil Port, New Orleans, La.)

Honeywell, Inc., Government and Aeronautical Products Division, Minneapolis, Minn., \$2,881,209 contract for low cost studies for development of ring laser gyro. (Naval Regional Procurement Office, Long Beach, Cal.)

Robert Jenkins Oil and Gas Ltd., Yorkshire, U.K., \$660,000 order to supply separation equipment for the Ninian Northern oil field platform in the North Sea. (Chevron Oil U.K. Ltd., Croydon, England)

Western Electric Company, Greensboro, N.C., \$21,971,974 contract for oceanographic research. (Naval Electronic Systems Command)

Northrop Corporation, Los Angeles, Cal., \$7.3 million contract for continued production of MQM-74C target aircraft, used in anti-aircraft training of missile and ground gunnery crews. (U.S. Navy)

Bethlehem Steel Corporation, Bethlehem Singapore Private, Ltd., contract of unspecified amount for a mat-supported mobile jackup drilling rig. (China National Machinery Import and Export, Peking, China)

Kaiser Steel, Oakland, Cal., order (terms not disclosed) to fabricate an offshore mooring unit for use in the Santa Barbara Channel off southern California. Unit will be installed in 490-ft. waters and will be the anchor point for a 50,000 dwt vessel which will store and treat oil from a oil production platform in the Hondo oil field. (Exxon USA, New York, N.Y.)

Scientific Radio Systems, Inc., Rochester, N.Y., contracts totalling \$342,753 for a number of 1000 watt and 125 watt high frequency single sideband communications for installation throughout Saudi Arabia. (Western Electric Company)

Western Gear Corporation, Industry, Cal., \$3.5 million contract for the design and construction of the foilborne gearbox for five high-speed, missile-carrying U.S. Navy patrol hydrofoils. (Boeing Marine Systems, Seattle, Wash.)

Halter Marine, Moss Point, Miss., order for seven 180-ft. offshore workboats. Deliveries will commence in October, 1978. (Seahorse Inc., Morgan City, La.)

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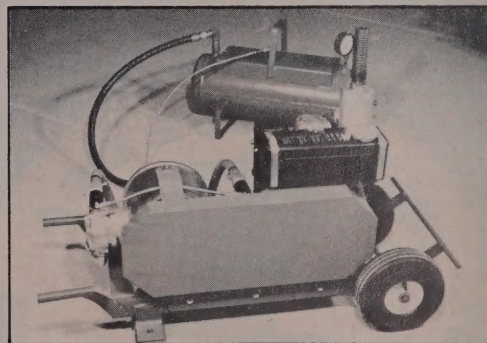
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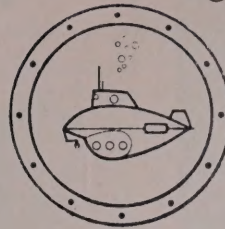
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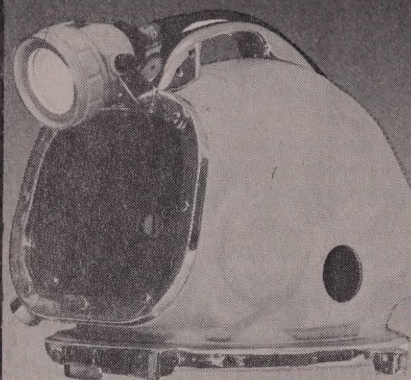
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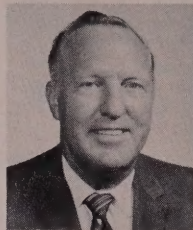
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People



G. Martin



G. Watts

George Martin has established an engineering consulting firm in Washington, D.C. Project Engineering, Inc. will specialize in plans and programs for marine industry and government.

George Watts has joined Tetra Tech, Inc. as Director of the Engineering Division of the firm's Washington, D.C. office. Before joining Tetra Tech, Watts worked for the U.S. Army Corps of Engineers.

James Stoffer has been appointed Division Manager of Columbia Research Corporation's new Tidewater operation in Virginia Beach, Va.

Dr. George Cressman, Director of the National Weather Service, has received the International Meteorological Organization Prize from the World Meteorological Organization. The NOAA official was honored for "outstanding work in meteorology and international collaboration."

Eraldo Coscarelli, John Nowotny and **John Scribe** recently shared a Navy Group Achievement Award. The three researchers at the Naval Ship Engineering Center, Washington, D.C., worked together on developing a multi-functional mast antenna for submarines.

Seatrains Shipbuilding Corp., New York, has named **Ralph Ryan** as president. Before joining Seatrain, Ryan was vice president, quality assurance for Ingalls Shipbuilding Corp., Pascagoula, Miss.

Dr. Thomas Mathai has been named Vice President, Data Services for RCA Global Communications, Inc., New York. In the newly created position, Dr. Mathai will be responsible for the development, expansion and profitability of RCA Globcom's Data Services product line in the international marketplace, which includes overseas data communications, facsimile and alternate voice/data communications.

Joseph Cherry has been promoted to director of quality assurance at ITT Cannon Electric, Santa Ana, Cal. ITT Cannon Electric is an international producer of electrical connectors and electronic test accessories.

Wayne Rutledge has been promoted to vice president over the Marine Services Division of Jet Research Center, a wholly-owned subsidiary of Halliburton Company. The Center, based in Arlington, Tex., offers specialized services including wellhead abandonment, vessel salvaging, harbor deepening and pipeline trenching.

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CIRCLE NO.32 ON INQUIRY CARD

SALE OF GOVERNMENT PROPERTY SPECIAL SEALED BID—TERM CONDITIONS

INVITATION FOR BIDS NO.

MON-S-80-3

PAGE 5

A. BID DEPOSITS.

All bids must be accompanied by a bid deposit which must be in the possession of the Contracting Officer by the time set for bid opening. Bid deposits shall be in the form prescribed in Condition No. 4, General Sale Terms and Conditions (Standard Form 114C). Unless otherwise provided in the Invitation, a bid deposit of 20% of the estimated total contract price is required on sales not exceeding one year; sales exceeding one year's duration will require a bid deposit computed at 20% of the total price estimated for one year's removal of property. Deposit Bond-Individual Invitation, Sale of Government Personal Property (Standard Form 150), or Deposit Bond-Annual, Sale of Government Personal Property (Standard Form 151) are NOT acceptable as bid deposits. In accordance with Condition No. 6 of the General Sale Terms and Conditions entitled "Payment" (Standard Form 114C), the 20% bid deposit submitted by the Purchaser will be retained by the Government and applied against the last delivery effected under the contract. At the option of the successful bidder, a Performance Bond (Standard Form 25) may be substituted by the successful bidder for his bid deposit at any time after notification of award of the contract. Any bid which is not timely supported by a proper bid deposit may be rejected as non-responsive. Any bid deposit received after bid opening will be considered in the same manner as late bids.

B. MODIFICATION OR WITHDRAWAL OF BIDS.

Bids may be modified or withdrawn by written or telegraphic notice and a bid also may be withdrawn in person by a bidder or his authorized representative, provided his identity is made known and he signs a receipt for the bid. Any bid modification which increases the amount of a bid already submitted or which submits bids on items not previously bid on must provide for an increased bid deposit.

C. CONSIDERATION OF LATE BIDS, MODIFICATIONS, OR WITHDRAWALS.

Bids and modifications or withdrawals thereof, must be in the possession of the Contracting Officer by the time set for bid opening. Any bid, modification, or withdrawal received after the time set for bid opening will not be considered unless received by the Contracting Officer prior to award, was mailed (or telegraphed where authorized) and in fact delivered to the address specified in the Invitation for Bids in sufficient time to have been received by the Contracting Officer by the time and date set forth in the

Invitation for the bid opening, and, except for delay attributable to personnel of the sales office or their designees, would have been received on time. In no event will hand-carried bids or withdrawals be considered if delivered to the Contracting Officer after the exact time and date set for bid opening. However, a modification which makes the terms of the otherwise successful bid more favorable to the Government will be considered at any time it is received prior to award and may be accepted.

D. ADJUSTMENT FOR VARIATION IN QUANTITY OR WEIGHT.

Condition No. 12, General Sale Terms and Conditions (Standard Form 114C) is modified to authorize the Government to vary the quantity or weight delivered by 50% from the quantity or weight listed in the Invitation.

E. TERMINATION.

Unless otherwise provided in the Invitation, this contract may be terminated by either party without cost to the Government upon 30 days' written notice to the other, to be calculated from the date the notice is mailed.

F. FAILURE TO PERFORM.

In the event the Purchaser fails to make payment as required by Condition No. 6, General Sale Terms and Conditions (Standard Form 114C), or fails to remove the property as required by Condition No. 8, General Sale Terms and Conditions, and fails to cure the default within the time allowed by the notice given in accordance with Condition No. 9, General Sale Terms and Conditions, the Purchaser will lose all right, title and interest which he might otherwise have acquired in and to the property as to which the default occurred and said Condition No. 9, is modified to provide that the Government shall be entitled to retain or collect as liquidated damages a sum equal to 20% of the contract price for the quantity estimated to be generated within a 30-day period.

G. AWARD OF CONTRACT.

The contract will be awarded to that responsible Bidder whose bid conforming to the Invitation will be most advantageous to the Government, price and other factors considered. A written award mailed (or otherwise furnished) to the successful Bidder within the time for acceptance provided in the Invitation shall be deemed to result in a binding contract without any further action by either party.

SALES TO DOE & CONTRACTOR EMPLOYEES

Employees of DOE & DOE Contractors shall be afforded the same opportunity to purchase government-owned property as is afforded the general public, provided the employees warrant in writing prior to award that they have not either directly or indirectly:

1. Participated in the determination to dispose of the property.
2. Participated in the preparation of the property for sale.
3. Participated in determining the method of sale.
4. Acquired information not otherwise available to the general public regarding usage, condition, quality, or value of the property.

Signature

Date

67-18

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The President (914)693-9001
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145 Palisade Street
Dobbs Ferry, New York 10522



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503/551-2041

Thanks for stopping in the other day. This is the Sonic Hydrophone I mentioned: you could use the 3 piezo crystal units separately by removing them. My wife has Emphysema quite bad, and we had a bit of Vir yet, and also I usually work all night at my desk and sleep at odd hours. You should find me "on dock" when the weather warms up IN THE AFTERNOONS. Best to phone

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INSTRUCTORS

F. A. Andrews is a Professor of Mechanical Engineering and Director of the Graduate Program in Acoustics at Catholic University; PhD. Physics, Yale University 1950. Research and operational experience in the use of sonar search techniques in the deep ocean environment, and in psycho-acoustics.

B. E. McTaggart is a senior scientist with Tracor, Inc., currently assisting in the procurement of naval transducers. He holds a B.A. in physics from Boston University and an MBA degree from the University of Rhode Island. He has had almost 20 years experience in the field of transducer technology both as a designer and a manager. He held the position of Manager, Transducer Department, Raytheon Co., during the period 1970-1975. He has presented several papers on transducers at various symposia on underwater acoustics.

W. J. Trott has recently retired from the Naval Research Laboratory after 30 years of research in transducers and their calibration. Of this period 20 years were spent at the Navy's Calibration Facility at Orlando, Florida (now a division of NRL). He has published extensively and has been chairman of three writing groups for the preparation of international standard transducer calibration procedures. He is a consultant to NRL and Science Applications, Inc.

R. J. Urick entered underwater acoustics in 1942 as a research physicist at the Navy Radio and Sound Laboratory. Over the years he has contributed to most aspects of sonar, having written over 200 papers and reports, and is well known as the author of *Principles of Underwater Sound*, 2nd edition, 1975. He retired from the Naval Surface Weapons Center, and is now an Adjunct Professor of Mechanical Engineering at The Catholic University of America.

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TIME/DATES

February 5-7, 1980. Check-in will be at 8:00 AM on the first day. Classes will meet from 8:30 - 4:30 each day.

PLACE

The Royal Quality Inn, 4875 North Harbor Drive, San Diego, California.

HOUSING AND MEALS

Housing and meals are not provided as part of the course fee. However, the Royal Quality Inn has reserved a block of rooms for persons attending this course. Please make and confirm your reservations as soon as possible and indicate that you will be with

the Catholic University Program. Address inquiries to: Sales Manager, Royal Quality Inn, 4875 North Harbor Drive, San Diego, California 92106, (714) 224-3601.

FEE

The fee for the course is \$555.00. This fee includes a set of lecture notes especially compiled for this course, all supporting materials, and a Social Reception on the evening of the first day of class.

UNIVERSITY POLICY ON EQUAL OPPORTUNITY

It is the policy of the University to comply fully with those provisions of Federal laws and regulations prohibiting discrimination on the basis of race, color, ethnic origin, age, handicap, or sex in educational programs and activities, including admission thereto, and in employment. Inquiries may be directed to the Equal Opportunity Office, 310 McMahon Hall (202/635-5107).

THE CONTINUING EDUCATION PROGRAM OF THE SCHOOL OF ENGINEERING AND ARCHITECTURE E. J. Ott, Director

The Office of Continuing Education in Engineering and Architecture was established in 1977 to administer and develop programs responsive to the needs of the practicing professional Engineer or Architect. Some of the programs are: A series of credit-bearing, semester-length courses on the subject of sonar systems and ocean acoustics. These are presented at job sites; An Engineering Management Program leading to either a Certificate or a Master's Degree; A series of Short Courses designed to enhance the professional's ability to respond to changes in the environment or to technological advances; Finally, this office will tailor an educational package to meet the specific needs of an organization.

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COURSE DESCRIPTION

This course is designed for sonar systems engineers who desire a better understanding of underwater acoustic transducers. The objective of the course is to provide the participants with the current techniques employed by transducer engineers in the design of both projectors and hydrophones for sonar applications. Various element designs incorporating plates, cylinders, mass-loaded, moving coil, flexural, flexensional, and Helmholtz configurations will be discussed, together with the materials employed. A number of unusual transducers and calibration methods will be covered. Although some knowledge of acoustics and mathematical modeling is desirable, it is not a prerequisite for this course in order to gain a solid understanding of current practices and design techniques of sonar transducers.

OUTLINE

Transducers in Sonar. Historical introduction. The sonar equation and sonar parameters. Arrays and array gain. Basic transducer types and properties. Uses of sonar. Limitations on acoustics power output. (Urick)

Theory of Transducers. The four-pole electro-acoustic equations and their uses. Transducer efficiency and electro-mechanical coupling factor. Equivalent circuits and their uses in design. (Andrews)

Design of Sound Receivers (Hydrophones). System and environmental requirements. Selection of a design and transducer material. Mathematical modeling techniques. Packaging and materials problems. Examples of existing and developmental designs. (McTaggart)

Design of Sound Sources (Projectors). Problems of high-power, low frequency projectors. Selection of design: piezo-electric ceramic, magneto-strictive, moving coil, flexural, flexensional, etc. Material problems relating to high voltages, pressures, strains, and shock. Examples of existing and developmental designs. (McTaggart)

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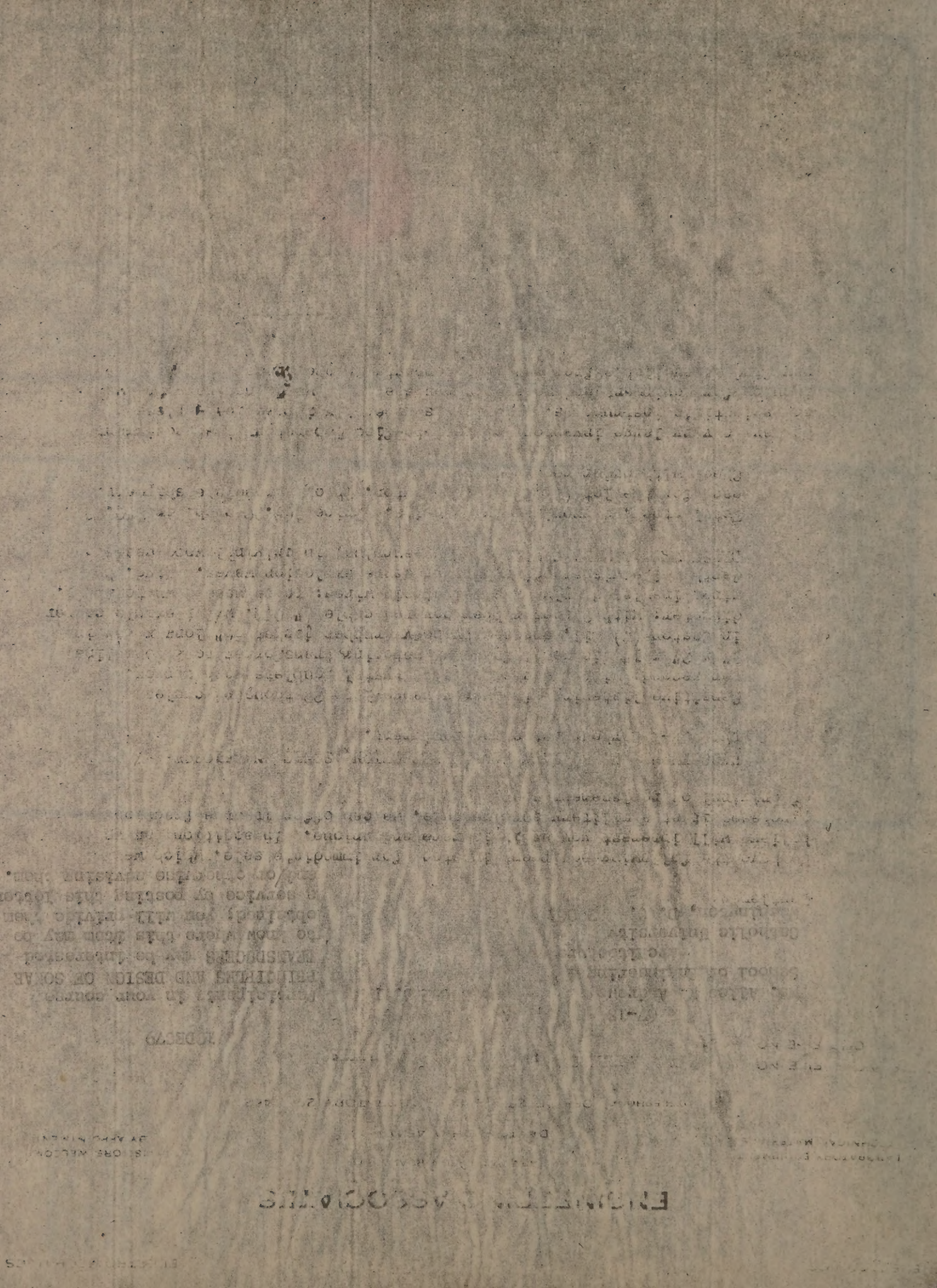
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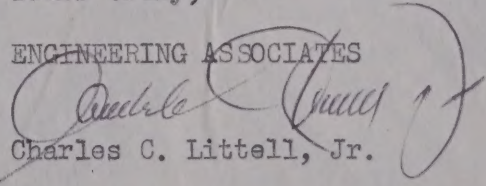
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